REMARKS

As a preliminary matter, the format of this Amendment B and the claim list herein complies with the January 31 notice of the Office of Patent Legal Administration, for OG Notices, "Amendments in a Revised Format Now Permitted", posted at:

www.uspto.gov/web/offices/pac/dapp/opla/preognotice/revandprac.htm.

This application stands with claims 25-45, 47-70 and 72-73, where claims 25 and 49 are independent and claims 30-31, 35, 51, and 56-57 are withdrawn as being directed to non-elected species.

Claims 25-29, 32-34, 36-45, 47-50, 52-55 , 58-70 and 73 are rejected under 35 U.S.C. §112, second paragraph, for indefinite language in claims 25 and 49. In response, claims 25 and 49 have been amended as recited above to correct antecedent basis and to more clearly recite that the cooling of the chamber wall from its rear face is meant as a cooling of the rear face of that wall. For this reason, Applicant respectfully requests that the §112 rejection of claims 25 and 49, and their depending claims 26-29, 32-34, 36-45, 47-48 and 50, 52-55, 58-70 and 73 be withdrawn.

Claims 25, 26 and 32 stand rejected under 35 U.S.C. § 102(b) as anticipated by ARINO et al. (U.S. 3,940,318), WEINECK et al. (U.S. 5,615,238), or WEINECK et al. (U.S. 6,160,862). Both WEINECK patents have the same parent application and therefore have similar disclosures.

In response, the cited references do not disclose or suggest an open chamber having inlet means for introducing gas into the chamber and outlet means for evacuating gas circulated through the chamber from the inlet means as recited in claim 25 as amended. In addition, claim 25 recites that the fission fragments are released into the chamber to interact with the gas

circulating through it. The open chamber is best viewed in Figures 5 and 19 of the present application.

In contrast, ARINO et al disclose a target element for the production of radioactive fission products in a nuclear reactor. The element has a cylindrical vessel with a thin, continuous, uniform layer of fissionable material integrally bonded to its inner walls. The bottom and the top of the cylindrical target element are sealed with stainless steel closures welded in place (column 4, lines 1-3). The top closure has a port, which is sealed to provide an entirely closed system during exposure to the neutron source, as well as at various subsequent stages. Therefore, the gas contained in the vessel remains confined and stationary in order to receive the fission fragments to be extracted for the production of certain nuclear species (such as $^{99}Tc^{m}$) while the element is irradiated. In no way can ARINO be held to disclose or suggest an "open" chamber with circulating gas as recited in claim 25.

Nor do the WEINECK et al references disclose or suggest all of the features of claim 25 for the same reasons as explained above for ARINO. Specifically, as shown in Figure 3 of both of these references, only a closed system or a non-open chamber is disclosed.

In addition, both of the WEINECK references disclose a target with a foil 22 of fissionable material which is not coated on the inner face of a chamber wall as recited in claims 25 and 49, but is instead sandwiched between two concentric tubes designated by 12 and 26 in Figure 1 of both patent references. For these reasons, Applicant respectfully requests that the §102(b) rejections of claim 25 and its depending claims 26 and 32 be withdrawn.

Further regarding claim 26, ARINO et al. teach directly away from the features of claim 26 which recites that the chamber and the fissile material coating are arranged to induce fission in *critical conditions*. While ARINO et al discloses the exposure of the fuel element to a neutron

flux (column 4, lines 4-5) in a nuclear reactor (column 1, line 9), ARINO et al do not suggest that the fuel element should be placed in a critical region of the reactor. ARINO et al's sealed vessel cannot be safely placed in critical conditions which would cause uncontrolled temperature and pressure increases inside the vessel. This is especially true when ARINO et al's device is only taught to be exposed to temperatures of up to about 300°C (column 4, line 21). Therefore, Applicant submits that the rejection of claim 26 is overcome on these additional grounds, and respectfully requests that the §102(b) rejection of claim 26 be withdrawn.

Claims 25-26, 28-29, 32-33, 36-45, 47-50, 52, 54-55, 58-59, 61-70 and 73 stand rejected as being "unpatentable" over PETTUS (U.S. 5,289,512) in view of BINGHAM et al. (U.S. 4,759,911) and further in view of CULVER (U.S. 5,873,239); EL-GENK (U.S. 5,428,653); or ROM (U.S. 3,202,582). In response, Applicant respectfully traverses because the cited references do not disclose or suggest all of the features recited in claims 25 and 49.

The Examiner appears to understand that the inner core of the nuclear propulsion reactor disclosed by PETTUS does not include a fissile material coated on a front face of the wall of the chamber in which the propellant gas circulates (i.e. a two-dimensional fuel layout), and modifies PETTUS with an americium carbide coating on a cylinder base material disclosed by BINGHAM to derive this feature. However, claim 25, and similarly in claim 49, also recites that the fissile material coating is "arranged to expose the fissile material to a neutron flux for inducing fission and the release of fission fragments into the chamber," and claim 25 adds "to interact with the gas circulating through the chamber."

No motivation exists to modify PETTUS with the fuel coatings disclosed by BINGHAM because BINGHAM teaches directly against the arrangement of fissile material and heating/cooling recited in claims 25 and 49 that results in fission fragments mixing with the gas.

BINGHAM instead discloses a gas-cooled nuclear fuel element comprised of a plurality of coaxial nested rigid porous cylinders of progressively decreasing circumference to allow positioning of each of the cylinders within the cylinder of the next largest size (column 2, lines 32-39). Each cylinder is made of a reticulated vitreous carbon skeleton of appropriate pore and ligament size, coated with a carbide fuel obtained by annealing uranium, plutonium or americium deposited by vapor deposition coating. After such coating, a protective carbon layer is deposited by chemical vapor deposition, and a final protective layer of zirconium carbide is deposited by chemical vapor deposition (column 3, lines 10-19).

BINGHAM et al's design optimises the fuel distribution across the thickness of the element in order to operate each cylinder at its maximum power level within the heat transfer constraints existing at its radial location. This is accomplished by having two protective coatings made of carbon and zirconium carbide which have the clear purpose of preventing the release of fission fragments in the gaseous cooling medium. BINGHAM et al merely proposes to heat up the cylinders in which the fission fragments remain confined, and to transfer the heat to the flowing gas. Simply put, BINGHAM is designed to eliminate fission fragments.

In direct opposition to this strong and clear teaching in BINGHAM, the present invention is directed to a chamber for creating fission fragments and maximizing the direct interaction of the fission fragments with the circulating gas. BINGHAM et al, like PETTUS, completely fail to suggest this efficient mode of operation which promotes the direct transfer of the high kinetic energy carried by the fragments produced by nuclear fission to the heated gas.

Furthermore, the Examiner appears to only use CULVER, EL-GENK or ROM to teach cooling the chamber wall from its rear face (i.e. means for cooling the rear face of the wall) as

recited in claims 25 and 49. These references also do not cure the missing feature of a fissile material on a chamber wall that provides fragments to be mixed with the gas.

For space propulsion, the combination of the heating/cooling mode of operation as recited in claims 25 and 49 with the placement of the fissile coating and the configuration of the chamber is very advantageous because it enables heating of the gas at very high temperatures without overheating the chamber wall. This is illustrated by figure 15 of the application where it is seen that the heating power distribution strongly decreases in the vicinity of the wall of the chamber. Along with the cooling of the chamber wall from its rear face as recited in claims 25 and 49, the above features provide the unique hot gas/cold fuel feature of the invention (*See* Application, pages 8-9).

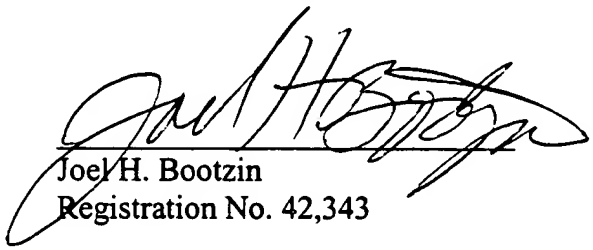
Since the claimed fuel arrangement was not disclosed nor suggested by PETTUS and BINGHAM et al, the mere citation of a further reference (such as CULVER, EL-GENK or ROM), even if these references, for arguments sake, disclose cooling the rear face of a reactor chamber, is not sufficient to derive the presently claimed invention as recited in claims 25 and 49. For these additional reasons, i.e. none of the references disclose or suggest release of fission fragments into the chamber when the rear face of the chamber wall is cooled, Applicant submits that the rejection has been overcome, and respectfully requested that the §103 rejection of claims 25 and 49 be withdrawn.

Claims 27, 34, 53 and 60 stand rejected under 35 USC §103 as being unpatentable over PETTUS in view of BINGHAM et al combined with one of Culver, El-Genk or Rom, and further in view of Chikin et al. "Gas Heating by Fission Fragments in the Channel of a Pulsed Reactor", Antomnaya Energiya, Dec. 1998, USSR, Vol. 65 No. 6) and Etherington (Nuclear Engineering Handbook). In response, since these claims depend from claims 25 and 49, Applicant repeats the

arguments from above used to overcome the rejections of claims 25 and 49. Specifically, none of these references disclose a coating of fissile material on a front face a chamber wall where the rear face is cooled and fission fragments are released into the chamber as recited in claims 25 and 49. For these reasons, Applicant respectfully requests that the §103 rejection of claims 27, 34, 50 and 63 be withdrawn.

For all of the reasons above, Applicant respectfully requests consideration and allowance of all pending claims. The Examiner is invited to contact the undersigned attorney to expedite prosecution.

Respectfully submitted,



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